UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/809,276	03/25/2004	Prabhakaran K. Centala	05516/148002	6042

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _27 June 2008_.
2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.
3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _2-9,14-23,25-38,40,45 and 46_ is/are pending in the application.
     4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5)☐ Claim(s) _____ is/are allowed.
6)☒ Claim(s) _2-9,14-23,25-38,40,45 and 46_ is/are rejected.
7)☐ Claim(s) _____ is/are objected to.
8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.
10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
     a)☐ All b)☐ Some * c)☐ None of:
          1.☐ Certified copies of the priority documents have been received.
          2.☐ Certified copies of the priority documents have been received in Application No. _____.
          3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
     * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)
2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3)☐ Information Disclosure Statement(s) (PTO/SB/08)
     Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
     Paper No(s)/Mail Date. _____.
5)☐ Notice of Informal Patent Application
6)☐ Other: _____.

DETAILED ACTION

1. Claims 2-9, 14-23, 25-38, 40, and 45-46 have been presented for examination based on applicant's preliminary amendment of 6/27/2008.

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 6/27/2008 has been entered.

3. Claims 10, 24, 39, 41-44 and 47-48 are explicitly cancelled.

4. Claims 11-13 are understood as cancelled as they depend from claim cancelled claim 10.

5. Claims 2-9, 14-23, 25-38, 40, and 45-46 remain are also newly rejected under 35 USC 112 $\P 2^{nd}$.

6. Claims 2-9, 14-23, 25-38, 40, and 45-46 remain pending in this application and stand rejected by the examiner under new grounds of 35 USC 103.

7. Examiner withdraws rejection under 35 USC 102 by Chen.

8. This action is made Non-Final.

Response to Claim Rejections - 35 USC § 103

9. New grounds of rejection are presented and applicant's argument are considered

and explained below.

10. Applicant has essentially cited Glass on Remarks Pg.2-5 stating Glass does not

teach computing ratio of radial force to WOB. Examiner respectfully diagrees as

Glass teaches computing radial force as Fx and Fz and weight on bit as Fy.

Glass Col.4 Lines 27-40 states:

> Given the input of bit Rate Of Penetration, Revolutions
> Per Minute, Rock Strength, cutter type, cutter location,
> cutter orientation and bed boundary location. The program
> 30 calculates the reactive force per cutter. These cutter forces
> are then summed to the orthogonal components of the
> general force system required to drill at the given input
> parameters. The orthogonal components are F_x (imbalance),
> F_y (weight on bit), F_z (imbalance), M_x (imbalance), M_y
> 35 (torque on bit), M_z (imbalance). These components are
> summed at the origin of the bit coordinate system. This
> coordinate system is attached to the bit as defined by the
> input cutter location data. Cutter forces are defined by a drag
> force and a penetrating force. The drag force is assumed to

This shows both that the radial forces & WOB are summed and computed.

As for computing the ratio, this is represented as percentage. Glass teaches further

in Col.5 Lines 47-56:

> In addition to the above calculations, when the bed
> boundary is encountered by a cutter, the force on that cutter
> is changed in proportion to the change in rock strength and
> 50 amount of engagement area in the bed boundary. The force
> on a cutter will change in proportion to the above parameters
> until it is fully engaged below the bed boundary.
>   The above outputs are generated once per revolution of
> the bit. The output includes cutter force per revolution as a
> 55 percent of weight on bit or torque on bit, cutter force per
> revolution and imbalance force per revolution.

This clearly shows that cutter force (for example Fx or Fz) in ratio to weight on bit

(WOB). Hence examiner finds applicant's argument unpersuasive.

11. In response to applicant's argument that the examiner's conclusion of obviousness is

based upon improper hindsight reasoning, it must be recognized that any judgment

on obviousness is in a sense necessarily a reconstruction based upon hindsight

reasoning. But so long as it takes into account only knowledge which was within the

level of ordinary skill at the time the claimed invention was made, and does not

include knowledge gleaned only from the applicant's disclosure, such a

reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209

(CCPA 1971). Applicant has not provided analysis showing that examiner has *not*

taken into account only knowledge which was within the level of ordinary skill at the

time the claimed invention was made, and ~~does not~~ include knowledge gleaned only

from the applicant's disclosure.

Claim Rejections - 35 USC § 112¶2nd

12. Claims *2-9, 14-23, 25-38, 40, and 45-46 are* rejected under 35 U.S.C. 112, second

paragraph, as being indefinite for failing to particularly point out and distinctly claim

the subject matter which applicant regards as the invention.

13. Specifically, amended claims 45 & 46 disclose limitation that evaluate, compare and

generate a ratio however the ratio is not used in the subsequent steps of *adjustment*

or *outputting*, therefore the claim is missing steps and the impact of these step on

indefinite in the claim. Respective dependent do not cure this deficiency and are

rejected for the same reasons.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

14. **Claims 2-7, 14-23 and 25-38 are and 45-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over "The Operational Mechanics of The Rock Bit", <u>Ma</u> et al, Petroleum Industry Press, Copyright 1996, further in view of U.S. Patent 6695073 issued to <u>Glass</u> et al.**

The Ma reference is a study of the dynamics of the interaction between the roller cone drill bit and rock (earth) including bit geometry, kinematics, axial loading, and the balancing (equalization) of forces acting on a roller cone drill bit. In particular, Chapter 6, and to some degree Chapter 5, of Ma sets forth the elements of what he refers to as the "New Methodology" for roller cone bit design. This "New Methodology" includes the use of drilling simulation and computer modeling for optimizing the parameters relating to the design of new roller cone drill bits. (See: page 1, paragraph 2, for condensed overview).

The examiner submits that the teachings of Ma render obvious the claimed limitations of the instant invention as presently claimed as follows:

*<u>**Regarding independent claim 45:**</u> A method for designing a drill bit, comprising:*

- <u>determining radial forces acting on a selected drill bit during simulated drilling;</u> (6.1, 6.1.2.3, 5.3, 3.3 - 3.5, Ma discloses drilling simulation, forces acting on roller cones

at least at pages 128, 129, section 5.1)

- evaluating the radial forces based on at least one selected criterion; (Ma teaches

forces acting on roller cones at least at pages 128, 129, section 5.1, which would be

an inherent part of optimizing the 3-D load model using finite element analysis

disclosed in sections 6.1-6.2.3 of Ma. (especially, 6.1.1.5))

- wherein evaluating comprises summing magnitudes of the radial forces with

respect to a direction to, generate a sum of the radial forces is a limitation not

explicitly taught by Ma and is taught by Glass (Glass: Col.4 Lines 27-56);

- comparing the sum of the radial forces to an applied weight-on-bit is a limitation not

explicitly taught by Ma and is taught by Glass (Glass: Col.4 Lines 47-56); and

- generating a ratio between the sum of the radial forces and the applied weight-on-

bit is a limitation not explicitly taught by Ma and is taught by Glass (Glass: Col.4

Lines 47-56);

- adjusting at least one parameter of the selected drill bit based on the evaluating;

(Ma: 6.1, 6.1.1.1, 6.1.2.3, page 232, lines 6-11, Ma sets forth adjusting design

parameters; Glass: Col.4 Line 58-Col.5 Line 11.

Regarding independent claim 46: *A method for designing a bottom hole assembly,*

comprising:

- determining radial forces acting on a bottom hole assembly during simulated

drilling, said bottom hole assembly including a drill bit. (6.1, 6.1.2.3, 5.3, 3.3 - 3.5,

Ma discloses drilling simulation, forces acting on roller cones at least at pages 128,

129, section 5.1, and a bottom pattern modeling at least in Figures 5-20 to 5-32)

- evaluating the radial forces based on at least one selected criterion; (Ma teaches

forces acting on roller cones at least at pages 128, 129, section 5.1, which would be

an inherent part of optimizing the 3-D load model using finite element analysis

disclosed in sections 6.1-6.2.3 of Ma. (especially, 6.1.1.5))

- wherein evaluating comprises summing magnitudes of the radial forces with

respect to a direction to, generate a sum of the radial forces is a limitation not

explicitly taught by Ma and is taught by Glass (Glass: Col.4 Lines 27-56);

- comparing the sum of the radial forces to an applied weight-on-bit is a limitation not

explicitly taught by Ma and is taught by Glass (Glass: Col.4 Lines 47-56); *and*

- generating a ratio between the sum of the radial forces and the applied weight-on-

bit is a limitation not explicitly taught by Ma and is taught by Glass (Glass: Col.4

Lines 47-56);

- adjusting at least one parameter of the bottom hole assembly based on the

evaluation (6.1, 6.1.1.1, 6.1.2.3, page 232, lines 6-11, Ma sets forth adjusting design

parameters *Glass: Col.4 Line 58-Col.5 Line 11).*

Hence, it would have been obvious to a skilled artisan having access to the

teachings Ma at the time of the invention to realize the elements of the present

invention as currently claimed. An obvious motivation exists since Ma teaches that

the elements as claimed, and noted above, can be combined in order to find an

optimum design and avoid bit (breakage) failure (chapter 6, section 5.4, especially

page 232, based on the entire teaching).

Further it would have been obvious to a skilled artisan having access to the

teachings Ma at the time of the invention to combine Ma and Glass as both of them

are directed towards modeling the drill bit and computing forces which is also a a

deficiency in Ma explicitly taught by Glass disclosing programmed calculations of

summed orthogonal cutter forces inclusive of weight-on-bit. (CL4-L27-46).

Per claims 2-7*: Ma renders obvious elements relating to performance parameters*

and cutting element interaction of a roller cone bit as noted above (6.1, 6.1.1.1,

6.1.2.3, page 232, lines 6-11)

Per claims 14-23 and 25-35*: The recited box-whisker plot is simply a well-known*

convenient way of graphically depicting a number summary, which consists of the

smallest observation, lower quartile, median, upper quartile, and largest observation

(See: CRC, or Wikipedia, for example) and hence would have knowingly been

implemented by a skilled artisan in order to graphically depict the summed forces.

Per claims 36-38*: Ma teaches adjusting bit design parameter (Section 6.1.2.3) and*

bit parameters (Ma: Chapter 2).

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15. **Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable under <u>Ma</u>, in view of <u>Glass</u>, in further view of "Drag-Bit Performance Modeling, <u>Warren</u> et al, SPE Drilling Engineering, June 1989"**

Analogous art Warren renders obvious elements of the present invention relating to simulating the <u>fixed cutter drill bit drilling an earth formation</u>; (pp. 119, col. 1, para:3-7, pp. 126, col. 1, para:2 to col. 2, para:3, Fig. 6) and determining a cutter-formation interaction force, relative sliding velocity, and cutting surface parameters on a cutter of the fixed cutter drill bit (pp. 19, col. 1, para:6, 7, pp. 126, col. 1, para:2 to col. 2, para:3, Fig. 6, Fig. 6).

Motivation to combine Ma with Glass is presented in the parent claim 45.

Hence a skilled artisan would have knowingly modified the teachings of Ma with the teachings of Warren, motivated using the same reasoning as previously cited above, to model and implement a fixed cutter drill bit. Ma teaches simulation and computation of forces acting on the drill bit (Ma: Section 5.3 "Simulation Test of the crater forming process by bit teeth" and at least on Pg.202 – as shown on previous page). Ma acknowledges that computer aided simulation and display is anticipated (Ma: Pg.207) analogous to the teaching of Warren (Warren: *pp. 126, col. 1, para:2 to col. 2, para:3, Fig. 6, Fig. 6*) and Glass (Glass: *Col.4 Line 58-Col.5 Line 11*).

Conclusion

16. All pending claim are rejected.

17. Claims 11-13 may further be rejectable by U.S. Patents 6039131 and 5937958.

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Communication

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to AKASH SAXENA whose telephone number is (571)272-

8351. The examiner can normally be reached on 9:30 - 6:00 PM M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Kamini S. Shah can be reached on (571)272-2279. The fax phone number

for the organization where this application or proceeding is assigned is 571-273-8300.

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USPTO Customer Service Representative or access to the automated information

system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Akash Saxena/
Examiner, Art Unit 2128

/Alexander J Kosowski/
Primary Examiner, Art Unit 2128